Proceedings of the Research Institute of Atmospherics,
Nagoya University, vol. 30(1983)

ACTIVITY REPORT

Section 1. Propagation of Atmospherics and VLF, ELF Radio Noise

An investigation of the electromagnetic environment in the frequency range from 30 Hz to 90 kHz was carried out in Kiruna and its suburbs in Sweden in November 1982, by a Grant-in-Aid for Overseas Scientific Survey from the Ministry of Education of Japan. In the near future, the Japanese natural wave investigation groups intend to carry out the simultaneous ground-based observation of natural wave phenomena with a satellite at Kiruna during the MAP period. So, one of purposes of the present survey was to find a suitable place with low noise level for the ground-based ELF-VLF observation. As the result of survey, several places to sensitively observe natural wave phenomena with a low noise level were found within 25 km from Esrange located 50 km east of Kiruna. The electromagnetic noises in the frequency range from 20 kHz to 90 kHz did not so much change with the observational places owing to the man-made signals, and several interesting natural wave phenomena, such as the diffused whistler waves, VLF emissions and quasi-periodic emissions, were also observed in ELF-VLF ranges.

A broadband arrey of four conical log-spiral antennae has been constructed in the east-west direction as the prototype of a large arrey to observe the so-called Jovian decametric radio waves. Covered frequency range of the conical log-spiral antennae is from 20 MHz to 100 MHz. The beam of the array can be steered by delay lines, thus the array is of panchromatic. Each log-spiral antenna has similar efficiency to that of a half-wave dipole with the ground plane at a frequency range between 20 and 100 MHz. The tracking time of Jupiter is about 5 hours centered at the meridian. Observation of Jovian decametric emissions has been carried out since last September.

In order to investigate the quantitative relationships between solar X-ray bursts and disturbances in the D-region of lower ionosphere, we have continued with the phase measurements for the electromagnetic waves of 22.3 kHz (NWC), 18.6 kHz (NLK), 11.3 and 10.2 kHz for four OMEGA stations at Aldra, Haiku, Reunion and N.

Dakota. Sudden phase anomalies observed at Toyokawa were reported every month at Solar-Terrestrial Environment Research Meetings and also reported to the World Data Center A at Boulder, U.S.A..

A computer simulation on the interaction of a solar wind with the earth's magnetosphere was executed using a three-dimensional MHD model as well as a two-dimensional one in order to obtain the configulation of quasi-steady state depending on the polarity of the interplanetary magnetic field. As the results, the characteristic features of the earth's magnetosphere, such as the bow shock, magnetopause, magnetosheath, magnetotail and plasma sheet were reproduced corresponding to the polarity of interplanetary magnetic field. Moreover, the magnetic reconnection process in the plasma sheet and the convection flows or volteces in the equatorial plane were represented to make a field aligned current from the present simulation.

Nonlinear mechanisms of strongly stimulated microwave beams have been analytically studied in the ionosphere and the atmosphere in order to examine the influence on the earth's environment and the proper design of satellite solar power station, which is proposed as an alternative energy source. The low-frequency wave phenomena in the atmosphere and plasmasphere have been also studied through the comparison between the earth and other planets in the solar system to clarify the unsolved problems in the earth and to survey electromagnetic and electrodymanical effects in the solar system.

February 26, 1983

- Tetsuo KAMADA -

Publications

Watanabe, T., T. Kamada, T. Ogino, H. Jindoh, S. Tokuda, and K. Ohta: A high-gain, broadband, steerable, decametric arrey to observe Jovian radio emissions:I. a 4-element array, Proc. Res. Inst. Atmospherics, Nagoya Univ., 30, (1983).

Kamada, T., T. Ogino and H. Jindoh: Investigation of the ELF-VLF electromagnetic environment in Kiruna and its suburbs, Proc. Res. Inst. Atmospherics, Nagoya Univ., 30, (1983).

Nakamura, Y. and T. Ogino: Numerical and laboratory experiments on spherical ion-acoustic solitons, Plasma Phys., 24, 1295-1315 (1982).

Kamada, T., M. Nishino, Y. Tanaka, T. Hirasawa and H. Oya: Observation of auroral hiss by the S-310JA-6 sounding rocket. Memories of National Inst. of Polar Res., Special issue, 18 (1981).

Kamada, T., S. Tokuda and T. Hironaga: On SPA events observed at Toyokawa during a decade from 1971, Proc. of RIA, Nagoya Univ., 29, 1-19 (1982).

Taguchi, K. and K. Sao: Errors of Decca LOP due to the metal structure of a ship, IEEE J. Oceanic Engineering, 7, 1, 59 (1982).

Taguchi, K., K. Sao, K. Yamashita and H. Jindoh: Cycle Jump on the OMEGA Hawaii as received in Japan. Trans. IECE Japan (in Japanese) in press (1982).

Ogino, T., H. Sanuki, T. Kamimura and S. Takeda: Nonlinear evolution of the kink ballooning mode in a toroidal plasma, J. Phys. Soc. Japan, 50, 1698-1705 (1981).

Tsukabayashi, I., Y. Nakamura and T. Ogino: Reflection of a cylindrical ion-acoustic soliton at a symmetric axis, Phys. Lett., 81A, 507-510 (1981).

Ohe, K., T. Ogino, K. Asano and S. Takeda: Nonlinear dispersion relation of finite amplitude ionization waves: I. Theory and numerical calculations, J. Phys. D: Appl. Phys., 14, 1009-1021 (1981).

Ogino, T. and H. Jindoh: Observation of ELF and VLF atmospherics and their numerical simulation, Proc. of RIA, Nagoya Univ., 28, 1-11 (1981).